N.A.C.A. BULLETIN

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ABOUT THE AUTHORS

JOSEPH V. MICCIO (Quality Maintenance Features of Wage Incentive Plans) has been Comptroller, Secretary, and Treasurer of Aircooled Motors, Inc., Liverpool, N. Y. since 1945. Mr. Miccio came to his present company from Republic Aviation Corp. where he held the position of Financial Assistant to the Vice President for a three-year period. He has held responsible industrial accounting posts since 1932. A previous contributor to the *Bulletin*, Mr. Miccio is known for his interest in the problems posed by wage incentive installations.

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JAMES A. CAMPBELL (Common Sense Budgeting for Manufacturing Expenses) is a Partner in the firm of Arthur Andersen & Co, Chicago, Ill. He is a Certified Public Accountant of both New York and Illinois, as well as of several other states, and holds the degree of M.B.A. from the Harvard Graduate School of Business Administration.

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EARL K. JOHNSON (An Accounting Procedure for Expenditures on Experimental Projects) is Senior Procedures Analyst, New Holland Machine Division of the Sperry Corp., New Holland, Pa. Before joining his company, Mr. Johnson was employed in a like capacity with Radio Corp. of America and has held posts as Cost Analyst and Plant Accountant with affiliates of Reynolds Metals Co.

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O. A. REDHAIR and P. J. EICHINGER (Processing Accounts Payable in a Large Company) are connected with Westinghouse Electric Corp. Mr. Redhair is now Assistant Director in Charge of Government Accounting and is located at the company's office in Pittsburgh, Pa. At the time of preparation of the article he was Manager of Accounting at the Sharon (Pa.) Division where Mr. Eichinger holds the position of Factory Accountant.

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JULY 1, 1949

QUALITY MAINTENANCE FEATURES OF WAGE INCENTIVE PLANS

by JOSEPH V. MICCIO, Treasurer and Comptroller,
Aircooled Motors, Inc.,
Liverpool, N. Y.

The author of this paper believes that, far from promoting quantity production at the sacrifice of quality, well-administered wage incentive plans serve to focus attention on the minimization of scrap and spoilage. He presents a list of nine points in support of this position and elaborates on the more important of them.

IT IS my conviction that quality does not suffer under production incentive systems. In fact, it has been my experience that quality usually improves where a carefully thought out and well-administered wage incentive system is installed. Unfortunately, it is often found that management groups tend to use incentive plans, not to supplement good management, but as a substitute for good management. Where this condition exists quality will inevitably suffer and the cost per unit of production will increase by leaps and bounds.

Incentives Should Mean Improved Supervision and Inspection

Entirely too many organizations regard incentive systems as a self-policing measure for labor which permits management to economize on supervision. Actually, the industrial executives who obtain best results from incentive plans in the form of reduced waste and lower cost per unit have found that improved supervision is needed and necessary for the welfare of the employee as well as the company. To prevent waste due to defective material, provision must be made for adequate inspection. This is vital under a wage incentive system. Satisfactory work performed on defective material cannot be charged against an employee. Management must make provision to detect defective material at stated points during the operating process to prevent excessive labor costs due to defective material. This is especially important under group incentives where successive operations may be performed within a group.

Nine Points at Which Quality Control and Incentive Plans Dovetail

Perhaps the best approach to our subject is to search out and list the major causes of scrap and inferior quality and in so doing to determine how to eliminate these causes to the greatest possible extent. In the course of this review we will be able to see readily how a well-planned and administered wage incentive system can help at many points to bring to the foreground the problems connected with quality maintenance and the need for their solution.

1. *Materials not to specification.* All well-managed organizations have complete material specifications precisely established for all materials required in connection with their manufacturing process. This is a very important item in a wage incentive system and generally, under such wage incentive system, it is very well understood by all employees who utilize material. Where material is not up to specification and, as a result, will cause additional machining time or increase the possibility of scrap, the employee will be the first one to bring this condition to the attention of supervision as it will vitally affect his earnings. Where, however, a wage incentive system is not in operation and materials are received but not in accord with specifications, this might not be detected until the fabrication process was well under way and, in many cases, not until the finished article is completed. In this instance, then, it is very plain that wage incentives help to improve the quality and maintain company specifications.

2. *Process Sheets.* In order to operate under a wage incentive plan, it is vital that detailed cost sheets outlining each operation to be performed and the sequence of such operations be compiled and released to the time study group as well as the production foremen. Where a wage incentive system is in operation, care is exerted by timekeepers as well as the individual employee to make certain that each of the operations is followed in proper sequence. So far as the individual employee is concerned, he is especially critical if a change of processing takes place which results in an increase of machining time without the corresponding adjustment to the labor standard. Where wage incentive systems are not in operation we very often find that, while a process sheet might have been originally prepared, the actual procedure followed by the shop may greatly vary from such process sheets and in many cases the variation results in missing operations which cause rework and oftentimes scrap.

3. *Receiving Inspection.* In order to insure minimum scrap and rework costs, it is vital that each organization maintain a well-organized receiving-inspection procedure. Of course, the standards will vary with the product manufactured. Through the use of magnaflux on ferrous metals and the zyglo process on nonferrous metals, defects in the materials can be detected before actual use of such materials in the fabricating of parts or assembling of purchased parts into the finished product. Where the strength of materials is a very important factor, a well-established organization will maintain a metallurgical laboratory for tensil strength testing and the analysis of material structure. With regard to castings and forgings and subsequent machining, it is very important that the receiving inspection procedure provide for testing and measuring of the locating points on such castings and forgings in order to prevent run out errors in the subsequent drilling or milling.

Here again, where a wage incentive system is in operation, the employee will be very quick to bring to the attention of management any material defects in order that these will not become deductions from his earnings. It is, however, important that such defects in materials be determined prior to the actual performance of work on materials in order to avoid payment for work on materials which are eventually scrapped. This is where the inspection department as well as the production foremen can be of great service to the company.

4. *The use of incorrect or defective tools.* Another principal cause of scrap or inferior quality is often found to be the result of the use of incorrect or defective tools. When such tools result in increasing the time required by the employee for fabrication of parts, in cases in which a wage incentive system is in operation, this condition will in most instances be immediately brought to the attention of the production foreman by the individual employee. However, if the use of such tools does not affect the fabrication time but does result in inferior quality, the problem will generally be detected only through proper supervision and careful process inspection. In my opinion, quality might well be protected here by going to some expense for more rigid tooling and tool inspection.

5. *Improperly sharpened tools.* Since dull tools are most apt to increase machining time, we are more likely to find employees

using sharp tools where a wage incentive system is in operation. On the other hand, where employees do not earn a premium for speed of operation, we are most apt to find that tools are left on machines long after the time when provision should have been made for their sharpening. In my estimation, considerable scrap has been generated due to lack of sharp tools. This is increasingly the case where the depth of the cut increases. Where a wage incentive system exists, the employee will help bring to the attention of his foreman the need for sharpened tools. Nevertheless, this does not relieve the production foreman and the inspector from the responsibility of being on a constant lookout for such a condition.

6. *Insufficient operational process inspection.* Too often in business organizations we find that the inspection is made after the article is finished, notwithstanding that there may have been several individual fabricating operations performed prior to completion. This means that, if the fabrication at the second operation were incorrect, the company has not only lost material but it has also lost labor on the first two operations and the labor on succeeding operations. This brings out the importance of establishing a setup for operational process inspection.

Where a wage incentive plan is in operation, arrangements are generally made not to pay wage incentives for succeeding operations where the defect is obvious to the employees who perform such succeeding operations. However, too often such imperfections are not observable and, unless sought out by a trained inspector and inspection equipment, will not be determined until the finished product arrives at the final inspection point. This is a very important item in connection with group incentives and, where a group incentive plan is in operation, there is a very definite need for operational inspection. At a later point in this article in the course of discussion of quality control records, a suggested method of establishing operational inspections will be discussed. Strong inspection with definite specifications is a necessary accompaniment of quality incentives.

7. *Agreed upon quality standards.* A very important factor that causes a great deal more scrap than we realize is the lack of quality standards agreed to by the engineering, procurement, production, and inspection divisions before actual procurement or

fabrication starts. This not only results in scrap losses and production delays but also has, in many companies, resulted in the growth of hard feelings among the several departments. Where a production wage incentive system is found in operation, we are more apt to find that such standards have been previously agreed upon for, in order to establish fair wage incentive rates, it is first necessary to know the specifications on materials, finish, etc. If, perchance, under a wage incentive system such standards were not predetermined, the matter would be rapidly brought to a head by the employees, themselves, who will object strenuously to any changes in quality requirements without corresponding changes in the time standards.

8. *Quality control records.* Another item which is constantly overlooked and is a direct cause of abnormal scrap and poor quality is the lack of proper statistical records pertaining to inspection, scrap, and rework. A section of this article will be devoted to the need for such type of basic records. Suffice it to say at this point that, without quality control records, the extent to which scrap and rework costs exist will never really be determined. It is also important to note that such quality control records are a prerequisite of a properly installed production wage incentive plan and, where such records are in existence and analyzed by production management, quality will inevitably improve and scrap and rework costs decrease.

9. *Incentives for inspection personnel.* Have we ever stopped to consider that the lack of wage incentives for inspection personnel might also be a reason for scrap losses as well as inferior quality? From first observation, we might ask, "If the inspector does not actually produce the piece, how can he be responsible for inferior quality?" Yet a little further thought on the subject leads us to realize that where the productivity of the production employee increases through incentive, the inspector is expected to inspect a larger quantity of pieces and thus would have to work harder than if an incentive plan for production personnel were not in existence. Unless the inspector is also given an incentive for his extra effort, he will either become less intent in his inspection procedure in order to keep up with the pieces made or he will let them pile up. In either case the company stands to lose because pieces of inferior quality will be made for a longer

period of time without detection. A separate section of this article will be devoted to some incentive plans for inspection personnel which have been used successfully in various industries.

Strengthening Quality Control

The somewhat broad areas which have been covered are not the only points at which quality control and production incentives meet. The following more specialized considerations are offered with respect to improving quality under production wage incentive systems:

1. While the group incentive has a very definite place in production wage incentive systems, it should not be used too loosely in order to dodge clerical work. We must always keep in mind that the further removed the measure of productivity is from the individual, the more difficult it is to not only increase the production but also to maintain good quality.
2. It is imperative that all operations be standardized and identified because this, in itself, will help reduce scrap and also make it much easier to place responsibility for and determine the cause of scrap or poor quality.
3. A wage incentive plan should not be installed without the proper administrative control because, to do so, will inevitably result in the employee's literally running away with the earnings at the expense of quality.
4. Handled carefully, another means of maintaining good quality is to promote where scrap is consistently at a minimum and to demote or release where scrap increases. We should remember that promotion is still the strongest incentive for superior employees.
5. One successful type of incentive plan that has been used is that under which an operator is given a varying number of machines which he operates as a battery. His pay increases with the number of machines run. If the work from these machines is found to be defective, the number of machines that he is allowed to control is arbitrarily reduced and, with the reduction, is a reduction in the rate of pay. Under such a plan, the maximum and minimum number of machines which an operator is allowed to run

is generally prefixed and publicized, and this creates an additional incentive to make good pieces.

6. Thought should also be given to the advisability of paying an additional premium to production incentive employees where their production results in consistently less scrap than that which was originally allowed. This device should be used very cautiously since we must recognize at the outset that the wage incentive system is predicated on the principle of paying a premium only for good pieces produced.
7. Another plan which has had some success in reducing the total amount of scrap and inferior workmanship is that under which a penalty deduction is imposed upon the employee for defects which are detected over and above an allowed percentage. The percentage is generally determined by evaluating the cost of the lost materials and labor performed up to the operation at which the scrap is generated. In cases in which a piece is susceptible of repair, the employee will receive credit for the finished piece less a standard repair cost. Caution should be exercised in the adoption of such a plan in that, unless very carefully administered, extremely difficult industrial relations problems might develop.
8. The production supervision bonus or incentive plan should be so established that the amount of bonus is contingent upon the relationship of actual scrap and inferior work performed by employees under the jurisdiction of the pro-production supervision as compared to a standard allowance. Where this exists the foreman or supervisor is likely to have a much keener interest in the quality of the work produced.

Serviceable Inspection Records

In order to determine the extent to which scrap and inferior workmanship exist and what they are costing the company, the following records and reports seem to me to be required:

1. *A material review report.* This report, illustrated in Exhibit 1, should be prepared by the inspector for materials rejected. The report should show all vital information concerning the part, operation, machine, and nature of the defect. It is also recom-

FORM NO. 705
AIRCOOLED MOTORS, INC.

USE No. 4 PENCIL — PRESS HARD

MATERIAL REVIEW REPORT

M. R. R. NO. _____
DATE _____

PART NAME _____
PART NO. _____ ASS'BLY NO. _____
MODEL NO. _____ ENGINE NO. _____
SERIAL NO. (S) _____

VENDOR _____
ADDRESS _____
REC. REPORT NO. _____ DATE _____
P. O. NO. _____ ACC'T NO. _____

REJECTED IN DEPT.. NO. _____ STORES NO. _____

QUANTITY REJECTED	JOB ORDER NUMBER

REJECTED IN RECEIVING INSPECTION —

TOTAL QUANTITY RECEIVED	QUANTITY REJECTED

REASON FOR REJECTION

RESPONSIBLE EMPLOYEE NO. _____

INSPECTOR _____

REWORK PER INSTRUCTIONS OR SKETCH

DISPOSITION

DATE _____
ROUTE MATERIAL TO _____

RESPONSIBILITY

VENDOR'S NO ☐ YES ☐
REPLACE ☐ REPAIR ☐ CREDIT ☐
DEPT. NO. _____ CHARGE A/C _____

CUSTOMER'S-VENDOR INSPECTOR

REFERENCES

SHIPPER NO. _____ TRANSFERRED TO
S. P. O. NO. _____ JOB ORDER
P. O. NO. _____ NO. _____

SALVAGE ENGINEER

RECAPITULATION

ACCEPT PCS. _____ RETURN PCS. _____
REWORK PCS. _____ SCRAP PCS. _____
PCS. ACCEPTED AFTER REWORK _____

SALVAGE INSPECTOR

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mended that the report, wherever possible, show the employee responsible in cases in which the rejection is due to defective workmanship. The report should further show the ultimate disposition of the rejected item. This report is prepared in triplicate so that the original may be transmitted to the accounting department for proper handling through the accounting records, the duplicate sent to the production superintendent as immediate notice of all rejects under his jurisdiction, and the triplicate kept with the material until collected by the inspection department for use in statistical compilations.

2. *Weekly scrap report.* This report should be prepared from the copy of the material review report, mentioned above, to be picked up by the inspection department. The initial report should contain part number, operation number, quantity, unit price, and total price. The dollar values can be obtained from the accounting records. Further, the report, to be effective, should be prepared departmentally so that management can immediately determine scrap costs by department. There should also be a total summarization by end product produced. The latter summary will give some vital statistics in arriving at actual costs on items manufactured.

3. *Operational quality control chart.* The quality manager's or chief inspector's greatest concern is the extent to which his inspectors are performing operational inspection which, to my mind, is the most valuable type of inspection that can be performed within an organization. His concern is minimized on finished pieces since, in most organizations, some sort of a record is prepared for the movement of the finished pieces either into the storeroom or to an assembly line. In such cases he can require the inspector's signature to be placed on such a "move" ticket. However, in a great many organizations, there is no such record in existence as the pieces move from operation to operation within a given department. In order to make certain that a sufficient amount of operational inspecting is being performed and thereby help to substantially reduce poor quality and scrap, it is strongly suggested that an operational quality control card be established as a basic part of inspection procedures. The quality control card referred to above is generally prepared in duplicate and is placed on each machine as new jobs are assigned to production employees. This card provides for the following vital information:

1. Part number.
2. Operation number.
3. Machine on which part is produced.
4. Department number in which part is produced.
5. Production order number.

The card should be so designed as to provide room for the inspector's comments and signature. The card should be further designed so that room is available for more than one inspection during the time in which the part is being produced. The first copy of the card should be delivered to the foreman for his review daily and the second copy should be maintained in a part number file in the inspection or quality department. This file should be referred to constantly during any finished part inspection so that the finished parts inspector may know the extent to which operational inspections have been made. With this information, the finished parts inspector can determine the extent to which it is necessary for him to make intensive inspection of finished pieces. Further, the card, containing comments as mentioned above, will afford a basis for placing direct responsibility for defective work. It will also make possible a check on the functional operation of the machine tool as well as the correctness of the drills, jigs, and fixtures that are used in performing the operation in question. This same card becomes a supervisory control by the quality manager or chief inspector in making certain that his process inspectors are performing a sufficient number of inspections daily so as to help keep defective work at a minimum.

4. *Tool inspection record.* At the outset all tools should be kept in a centralized location under the jurisdiction of a tool storekeeper, similar to the manner in which production materials are controlled. The production procedures should be so established that all tools are carefully inspected by a tool inspector prior to their being placed in storage pending subsequent use. This has the effect of minimizing inferior quality and, at the same time, will prevent production delays when the tool is subsequently required. In order to accomplish the foregoing, a tool record should be maintained which should contain provision for an acceptance by the tool inspector to show that the tool was so inspected and is in a condition ready for subsequent use. Production procedure should also be established to require all tools to be withdrawn from the

production floor just as soon as the job on which they are used is completed. This will prevent loss and misuse.

Extending Incentives to Inspection Personnel

If there is any kind of work in a factory which may seem to be debarred from a share in financial incentive, it is inspection work. However, certain kinds of inspection have been timed and given bonuses since the later days of Frederick Taylor. As mass production increased it was found that, even where inspection was intermittent, the inspection time bore a definite relationship to the direct production time. It has become evident, therefore, that tasks can be established and incentives paid for inspection wherever the scale of production is large enough to justify the cost of determining a basis for such incentives. Without question, there is room for considerable additional research in the field of incentives for inspection personnel. Yet there are numerous organizations that have established incentives for their inspection personnel and have found that they resulted not only in reduction of inspection costs but also in the maintenance of good quality.

Reference may be made to American Management Association Production Series Bulletin Number 22 which describes how an electric appliance company determined from its past records a ratio between pieces produced and inspection required. The company in question then agreed to pay a one per cent premium for each one per cent reduction below the allowed inspection time. The incentive was so established that any subsequent rejections which were indicative of improper inspection resulted in a reduction from the inspector's premium. Any subsequent rejections falling into the above category which resulted in rework also resulted in a corresponding reduction from the inspector's earnings, for the cost of such rework. Subsequent inspection in either subassembly, assembly, or by customers via complaints also resulted in deductions from the inspector's current premium earnings if defects were revealed.

Where the inspection procedures followed by the individual company are such that it is impracticable to establish a financial incentive for inspectors based upon measurable effort exerted by them, there should nevertheless be some plan in operation through which the inspectors can be rewarded for additional effort expended as production increases. In my opinion, such an in-

centive can be based upon the total ouput of the department or group that the inspector directly services or, as a second choice, the average productivity of the production division.

Conclusion

It is my conviction that quality does not suffer under production incentive systems which are carefully thought out and well-administered but, rather, that quality tends to improve under such conditions. It is my further conviction that wage incentives are a good part of the answer to our present-day industrial relations problem. My conclusion is predicated upon the fact that, under a fair wage incentive system, the employee becomes, in attitude, a partner in the business and has a definite interest in helping increase output at a minimum cost and, at the same time, produce an income for himself which is commensurate with his particular skill, concentration, and interest on the job.

COMING ARTICLES

In the *N. A. C. A. Bulletin*, July 15, 1949

Needed—A Common Language for Financial Reporting
by Don Knowlton

A Simplified Income Statement for Employee Use
by Walter C. Burnham

What Operating Data for Collective Bargaining?
by George Kozmetsky

COMMON SENSE BUDGETING FOR MANUFACTURING EXPENSES

by JAMES A. CAMPBELL, Partner,
Arthur Andersen & Co.,
Chicago, Ill.

After giving consideration to the advantages of the flexible budget for control of factory overhead under present-day conditions, this presentation suggests that the work of a budget is merely begun with its establishment. The author lays emphasis on simplicity in budget application and points the way to its effective use in cost reduction activities.

WE ARE currently in a period when economics—the cold, practical kind which makes itself felt down at the net profit level—is not what it used to be. We face an immediate future the principal characteristic of which is uncertainty. We can probably anticipate a gyrating sales and production picture of the type which makes planning very difficult. It is against just this kind of a background that budgeting becomes most important. In 1949, management needs every possible type of assistance in questions of planning and control of operations. An effective budgeting operation can make this assistance very substantial over the whole field of a company's activities. This field is so broad that a single article is properly devoted to only a portion of it. This paper is directed toward the budgeting and budgetary control of factory overhead expenses for a manufacturing company.

Overhead: Fast Growing Category of Cost

This aspect of budgeting has been selected because overhead is, at least in a large part, not only controllable by management but less controlled than it should be. During the past ten years, overhead expenses have grown as fast, if not faster, than any other major type of cost. Companies have added production control, material control, and quality control. Supervision has expanded to keep pace with growth in output. New, intricate, and expensive machinery fills renovated or perhaps new buildings. All of these steps were taken with open eyes, but it is easier to gain weight than to lose it. I do not mean to imply that these developments have not

been desirable, but today's economics raise the blunt question of what we have to spend and what we can afford to buy with it.

Any phase of an effective operating budget operation should be related to a well-formulated over-all financial plan or so-called financial budget. The uncertain business conditions of today argue strongly that this financial budget should be reviewed frequently and revised as circumstances warrant. One satisfactory plan is to set the financial budget for a year at the outset and adjust it quarterly for the remainder of the year as the outlook may indicate. A variant of this procedure is a twelve months' forecast revised quarterly to reflect the latest estimate of conditions a year in advance. Whatever plan is followed should be flexible and up to date. It should take into account the latest and best judgment of all departmental executives concerned. It should be subdivided by the individual responsibilities of these departmental executives. It should represent a coordinated picture of over-all company planning, not merely a cross-footing of independent and often optimistic spending intentions.

Why the Variable Budget?

The manufacturing overhead budget ties into the financial budget as a part of the individual responsibility of the official in charge of production. Without relying too much on the pure crystal ball approach, it appears likely that the production outlook is far from static. If this is the case, factory overhead expenses will also be subject to similar variations. This would seem to call for modern equipment, the flexible or variable budget. A variable budget is primarily intended to meet the problem of rapid changes in production conditions, because it takes their ups and downs directly into account. By a variable budget, I mean one in which budgeted expenses are divided between fixed expenses and those which should vary with production. The budget allowance for a period represents the sum of the fixed expenses plus the variable expense assignable to the production level realized in the period.

A variable overhead budget has certain distinct advantages. The most important is a psychological one. A department foreman is continually under pressure to produce and to cut expenses. If he is measured against a budget set months ago at a production level very different from current operations, curious things can happen. If production is off and he has accordingly been able to cut ex-

penses, he makes a good showing. If production goes higher than the budget level and the foreman has to add an assistant, or perhaps a clerk, or use more welding rod or lubricants, he makes a bad showing. In neither case does the comparison mean anything in terms of how good a foreman he is. It simply shows how he has made out against a preordained, unchanging guess.

However, if the budget allowance against which the foreman is judged varies up and down with changes in production volume, comparisons mean more to him and to his supervisors. They measure what his overhead should be at all levels of production, not just at a single theoretical one. If he is trying to do a good job, they will keep him on his toes and he can be fairly appraised on the result.

First Technical Phase—Setting Fixed Expense Allowances

Setting a variable budget has, broadly, two technical phases—the determination of fixed expenses and of variable expenses. Both phases should be approached with an emphasis on simplicity—an important angle which will be gone into a little later. The determination of fixed expenses starts with a judgment factor—what level of operations is to be selected as the rock bottom signpost below which expenses could not ordinarily be reduced by a going concern? One frequently used level, which has perhaps more logical foundation than any other, is zero production resulting from a temporary shutdown. Fixed expenses at this level would fall into these principal classifications:

1. The costs of having a factory in operating condition—rental (if any), depreciation, property insurance, property taxes, and certain minimum maintenance and utilities.
2. Key personnel—largely supervisory—in those service activities which are regarded as essential under the policies in effect. Typical are such functions as timekeeping, employment and personnel, purchasing, production and material planning and control, time study, and plant accounting.
3. Supervisory personnel such as foremen and senior setup men in producing departments.

The second and third items just mentioned are costs of a type which become partly variable under other than shutdown status. Specific levels of production naturally require more supervisory and clerical personnel than the key force maintained during a shutdown. Of course, such items as taxes, insurance, and depreciation continue to eat up their not inconsiderable portion of the income irrespective of the level of production. Once the fixed expenses are determined, the amount allowed in the budget reports for a particular period is ordinarily assessed on a time factor—either one-twelfth for a month, one-fiftieth for a week, or so much per day times the number of working days.

Second Technical Phase—Setting Variable Expense Allowances

All the remaining expenses are presumed to vary with the rate of production and the setting of a budget is the determination of a rate per labor hour, labor dollar, machine hour, etc., for each such expense rather than a fixed amount. Which one of these elements is used in setting the rate will, of course, depend on the type of operation, available data, and convenience. For example, if machine hours are the customary measurement in a plant or in a department, it would follow that the variable expense rate would be set in terms of so much per machine hour. If labor dollars are readily available and widely used, the rate would be expressed in terms of labor dollars.

A widely used technique in setting the rate is the so-called scatter chart. For purposes of illustration, let us assume that we are dealing with a department where the rate is to be set on labor hours. Going back into the experience of perhaps the past year, points would be plotted on this chart to show what the particular variable expense had actually been at varying levels of production. A line of correlation would then be plotted or drawn to express what is presumed to be the constant relationship shown by experience. Technically, I suppose that this line should be plotted, but to avoid questions of higher mathematics it is usually drawn by eye. Once this line is drawn it is very easy to obtain, at any convenient level, the dollars of expense per labor hour by reading off the chart and dividing the two factors. This becomes the variable expense rate for the particular classification of expense in the particular department.

Apart from the problem of mathematics, one reason that this line is usually drawn by eye is that the relationship should be tempered

by sound judgment. Frequently the expense rate shown by pure experience will appear too high and, for purposes of wringing out any possible water, it will be desirable to set the rate somewhat lower and a new line will be drawn on the chart to reflect this decision. It also frequently happens that there are very wide swings from month to month so that the scatter of points does not form a consistent pattern. The reasons may be known and may be of a nonrecurring nature or they may not be known and may be viewed with the thought that, whatever happened, let us not have it happen again. In all cases of this type, it is common and probably wise to tighten up the budget allowance a little bit from the rate which would be shown by experience alone.

Another sound and widely used method is a head count at a known level of capacity, multiplied by what the heads are paid. No higher mathematics enters into this approach, but niceties of judgment are very much in the foreground. The mere fact that a man has seniority and the pay check that goes with it does not necessarily mean that he is a good yardstick of efficiency.

A variable expense rate, however determined, has at least one drawback which affects its use. In applying the budget allowance for a future period to the actual production of that period, the variable expense rate has in it the assumption that for each difference of, let us say, one labor hour in production output the budget allowance will directly vary by so much. In practice this is usually not the case because foremen deal with people, not small fractions of a worker. For example, if a particular department has four setup men at a production level of 10,000 units per day and these men are all doing a day's work, a five per cent reduction in production will probably not save one setup man, even though the setup budget allowance will be reduced for the five per cent drop in production. We still need the setup man and probably will until the load falls off by one-fourth.

The comparable situation is true in a number of other indirect labor accounts. How misleading the variable budget may be on this account is a matter of degree. It depends, among other things, on such questions as how much of the indirect labor is classified as fixed expense, how big the company is, and how much the drop in production may be. These factors will determine whether it is necessary to make special arrangements to deal with this situation

as a problem or whether, apart from making a mental note that we cannot save part of a man, nothing further has to be done about it.

Good Judgment, Good Budget

The necessity of applying sound judgment to past experience removes the fixing of variable budget rates from a desk job to one in which the coordination of factory management and accounting is of particular significance. The possible effects of new machinery or of deferred maintenance or of changes in layouts, methods of manufacture, and a host of other things, should be reflected in the budget allowance if it is to mean anything. Knowledge of these things, particularly knowledge of impending changes, goes beyond purely historical techniques. Whoever arrives at the budget allowances must be in close touch with production thinking and production processes. It is perhaps unnecessary to add that this same requirement necessitates knowing more than many accounting departments do about why things have happened. Intelligent budget men need to go far beyond the obvious fact that there have been changes in expenses. They must be familiar with causes so that the possibility of the recurrence of such changes can be fairly appraised.

The question of using judgment in budget allowances affects both fixed and variable expenses and affects them so much so that the better the judgment the better the budget. Strict reliance on experience is always the *easiest* way because we can usually find out what our experience has been. But this is not budgeting—it is merely *analysis*. With the very real possibility of troublesome times ahead, budgeting requires judgment, good judgment, and judgment based on a realistic, economy-minded philosophy.

What Can We Do Without?

To get down to cases, this philosophy might start out with investigating what we can do without. There are certainly no hard and fast rules covering what companies can do without and I have no intention of trying to develop any, but I will mention three broad areas which I have found worth investigating.

First, a number of plants seem to be still tied to overhead activities developed during the war when operating practices were in a measure based on whatever expedient could be adopted most quickly. Here there may be much to do without. These expedients

certainly worked. It does not follow that they are efficient under present conditions of lower production and more available materials. For example, many companies may not have revised their purchasing practices to agree with today's material procurement conditions. They are geared to smoke out scarce materials in quantity rather than to purchase in a buyer's market. Again, production control and material control methods often emphasize expensive safeguards to avoid running short of critical parts. Under present conditions, control methods might well emphasize inventory reduction and the storing and handling of minimum necessary quantities.

Second, doing without waste and inefficiencies is a goal which all plant managements would like to achieve. Their complete elimination is impossible, but progress toward this goal is not. All will agree that such items as rework, scrap, excess productive labor, and high usage of factory supplies and perishable tools occupy too large a place in overhead expenses. It may cost money to reduce these items, but proper expenditures in this line may turn out to be a bargain. Nowadays it is dangerous to take an offhand attitude towards matters of well-controlled tool cribs, good production counts, charging back of scrapped castings to the responsible party, and the prompt analysis of causes of defective work. These things are merely good factory management. It may be asked what they have to do with budgeting. They have a lot to do with it. Any 1949 variable factory budget should reflect anticipated improvements in efficiency. It must, if it is to be any help in bringing about the savings it is supposed to. The cost accountants who get away from their desks and out into the plant, can find out what is really going on and where savings possibilities lie. Otherwise the result of a variable budget may be the opposite of the purpose for which it was prepared. It may actually help to perpetuate high costs and inefficiencies.

The "doing without" philosophy does not, however, stop at this point. The third set of possibilities I wish to mention comes even more directly within the accountant's bailiwick. I refer to the *whole field of accounting methods and procedures.* Now, if ever, is the time for a new look through binoculars labeled, "Can we do it more cheaply?"

1. One of the few general rules of good procedures is the "one writing" principle—make the original writing serve

as many purposes as possible. This eliminates unnecessary reposting and unnecessary checking. It finds its expression in multicopy forms, simultaneous posting devices for payroll and general accounting, and mechanical aids such as mark sensing and the typewriter controlled punch.

2. Most companies prepare too many reports. Special reports become a permanent part of the accounting structure because no one remembers to initiate a stop order. Standard reports become outdated or perhaps useless. New reports are created on individual whims without followup to see if they are used and appreciated. This is a situation which every company ought to survey periodically—and 1949 is surely one of these periods.
3. Accounting machine manufacturers are bringing so much new equipment on the market that even those of us whose lives are spent between adding machine keys and offset reproduction processes find it difficult to keep up. Here is a whole field in itself, out of which I will pull only one thought. If you have any procedures bottlenecks, it does not hurt the pocketbook, if you have an intelligent grasp of your own situation, to let the machine salesmen review your problem to see what they may be able to offer.

Some Allowances to Discard

If again, we seem to have strayed from budgeting, I repeat that we have not. Budgeting should contemplate what can be done, not what has been done. A workable budget should be intensely realistic, but its realism in 1949 should be on the tight side. A budget is a method of procedure. The thinking behind it determines its effectiveness. Following this philosophy, I would make no allowance in a 1949 model budget for:

1. Overtime premium.
2. Excess productive labor due to inefficiency. (The actual results will probably show charges to this account, but the budget should discourage it.)
3. Shift premium, unless you have a sound basis for anticipating two or three shift operations.

On the same theme, budget allowances should be realistic but harsh on defective work, perishable tools, foundry scrap, and sim-

ilar items. The budget should take proper cognizance of expenses which ought to occur, but the pickings should be lean on things that, objectively viewed, should come in smaller and smaller doses.

Budget Applications Can Be Kept Simple

I have attempted to touch on the need for variable factory burden budgets, the basic mechanism of developing them, and the type of thinking which should lie behind the setting of budget allowances. Any discussion of this subject is likely to suggest complications which are more apparent than real. A variable budget can be a complicated piece of mechanism and it often is. With proper thinking and intelligent planning, it can be tremendously simplified and equally effective. Variable budgeting is a reasonable, intelligible concept, and the philosophy of effective economy which lies beneath it is an active part of any factory management. The variable principle, itself, is about as complex as the rise and fall of a moored dory in tidewater. Most of the complications come in overly refined views on departmental and account classifications. In short, the principle is a cinch but techniques can too easily obscure the issue. Something can usually be done about techniques and a variable budget is no exception to the rule.

I have seen variable budget statements with fifty or more account classifications and I have likewise seen them with a third of that number and have been unable to discern any additional effectiveness resulting from the additional detail. A simple and workable variable budget can be built around relatively few accounts. The basic requirements in the area of manufacturing expense are such items as supervision, inspection, setup (if not treated as direct labor), shop clerical expense, factory supplies, the various accounts reflecting the cost of good housekeeping, direct service department costs (such as tool repair), and such of the inefficiency accounts—like scrap—as may be budgeted. Use of a relatively few accounts simplifies the mechanical job of preparing the budget, makes it easier to report the results, and helps drive home comparisons.

Simplicity should also prevail in the number of departments or cost centers into which the budget is segregated. It is obviously desirable that the budget correspond to the physical departments, themselves, but combinations of departments for budget purposes can be quite satisfactory. Any such combinations must, of course, be limited to departments under the same individual's responsibility. However, it is a very frequent occurrence to find several de-

partments under a single foreman or general foreman, with assistants supervising the departments directly. Much can be gained by covering such situations by one departmental budget. The gain is in working practicability rather than meticulous accuracy. Nice accuracy means little if it makes the budget too complicated to work. Any company adopting a variable budget for the first time would be very well advised to condense the departmental breakdowns as much as possible. A budget is much like a system—the installation should be made as easy as possible. Refinements can come later.

Another road to simplification is in the matter of service department allocations. A short while ago I had occasion to analyze a case of careful distribution and redistribution of service departments on scientific bases. I was surprised to find that, even so, some seventy per cent of all service department expenses—including occupancy and factory general—were finally allocated to producing departments on a direct labor base anyway. This suggests several possibilities for shortcuts which run all the way from simplifying the *basis* of allocating service department expenses to producing departments, to not allocating them at all. It might be pointed out that, control-wise, there is much to be said for the last-mentioned method.

Responsibility for Cost Incurrence Basic to Effective Budgeting

It is to be remembered that, in establishing any sort of workable controls, translating the results into action always involves people. It can only be a *person* on whom the finger is put to do something about poor performance. It must be a *person* on whom the boom drops for a sudden skyrocketing in costs. It is entirely logical that factory control accounting on a strictly personal responsibility basis would follow. This sort of accounting would include budgetary reporting for each center of responsibility—taking into account, of course, the kind of combinations mentioned above. The budgeted and actual results shown for each such responsibility center would be limited to the items over which the particular department head or foreman has direct dollar control. He would not be assessed with expenses incurred by somebody else. They would come home to roost at the door of the man who incurred them.

This means that, so far as factory accounting for control purposes is concerned, there would be no interdepartmental allocation of overheads. This concept would not be irreconcilable with the product cost objectives of overhead accounting because the burden

rate is normally set in advance and burden absorption could be accounted for on the books in total and analyzed in whatever degree might be necessary.

There is a great deal of advantage in knowing exactly who is responsible for particular expenses. Typical factory overhead accounting obscures this point. A foreman called to task for an increase in expenses, the dollar amounts of which he can only partly do something about, is prone to alibi. Even if he is not the alibiing type of person, he would certainly be tempted to because of the beautiful opportunity handed him. What is worse, if the situation obscures responsibility, it may also obscure cause and, if a man does not know why something happened, his chances of fixing it are approximately equal to those of filling an inside straight. It seems necessary, therefore, that every dollar charged to a man be susceptible of being laid directly on his doorstep.

Go On From There

The purpose of a variable budget is to permit management to take proper action in the right spots on inefficiencies, poor performance, and similar causes of trouble. The budget, itself, does none of these things. It merely shows the way. Taking the action requires people and they, in turn, require full information. What I am getting at is that it is not enough just to have a budget. Someone has to do something about it.

Doing something about it certainly *starts* in the field of accounting and of the accountant, although I do not think he is the proper policeman for ultimate action. He should, however, see that the budget figures are released and reported promptly and intelligently. He should see that difficulties which he thinks are causes for action are properly explained on the reports—not just left as cold figures. His job should be one of rapid analysis and prompt and fully informed reporting so that operating management can do the physical policing that the budget reports indicate is needed.

I have seen far too little really interpretative reporting in my own experience, but I think it is fair to say that intelligent, analytical, and interpretative reporting of budget variances is the most important feature of the whole budget plan. I think I am also safe in saying that, even with a well-planned budget structure, the success or failure of the whole project of budgeting can still rest on how well accountants report the results.

POINTS OF VIEW

Many authors appear to disregard the fact that depreciation is the amortization (or "recovery") of original cost or investment of funds in equipment, over the estimated useful life of the equipment or asset. The practice of including in the depreciation provision an additional amount to cover current replacement cost is, in my opinion, unsound. If provision is to be made for replacement at current cost . . . label it for just what it is. Do not disguise it as provision for depreciation. *(E. Paul Love, Los Angeles)*

* * *

Many companies have industrial engineers making stopwatch time studies. We hear much criticism from the productive worker that the time study men expect too much. In my opinion, we should advocate training programs to acquaint foremen and leadmen with time study methods, with particular emphasis on performance rating. (Maurice W. Silvey, Lousiville)

* * *

It is comparatively easy to check someone else's work when you have all the advantages of hindsight on your side. When, however, you have to take the initiative and carry on an operation in a virgin territory, taking all the consequences of failure should you not succeed, the story is somewhat different. It is for this reason, therefore, that I believe that the accountants who are, or should some day be, in a supervisory capacity, should be "tried by fire" in the operating end of the business. *(John B. Bachofer, Kansas City)*

* * *

It would seem advisable to scrap "lifo" as soon as possible and get back to cost accounting instead of income tax accounting. (Kenneth D. Gillanders, Portland)

* * *

The fixed budget encourages cooperation and complete understanding all the way along the line, especially if the operating department heads have participated in setting up the forecast. If the period is not too long, say six months, the working estimate of plant capacity is probably known and a fixed budget can be prepared with a minimum of confusion and mystery. The fixed budget encourages decisions based on sound judgment, whereas the flexible budget tries to force decisions to agree with the technique. *(Allan R. Boge, Dayton)*

AN ACCOUNTING PROCEDURE FOR EXPENDITURES ON EXPERIMENTAL PROJECTS

by EARL K. JOHNSON, Senior Procedures Analyst,
New Holland Machine Division, Sperry Corp.,
New Holland, Pa.

The broad significance of product research to industrial companies and the administrative setup under which the experimental budget is developed in the author's company are the opening topics of the present article. In somewhat greater detail, the accounting procedures and records pertaining to product development costs are also set forth with stress on control aspects.

THIS case study deals with accounting control of costs for experimental engineering as established by a farm machinery manufacturer. In order that we may understand clearly the reasons for the records maintained it is necessary to deal, first, with the importance of product improvement to industrial companies and, second, to discuss what a product improvement program means in terms of the entire organization, before moving on to a description of the records which relate to the operations of the engineering staff and the incurrence of project costs.

Responsible management must do considerable planning if products are to be improved to the highest practicable degree. The related policy should recognize that product improvement can be attained only by constant and even costly experimentation. Hasty expansion and retrenchment in product improvement programs must be avoided, for there are many facets to the problem which may not be readily apparent. The continued existence of the company must be considered regardless of the current period profit and loss statement.

Planning and Executing Product Improvement—The Broad Picture

Fundamentally, there are two phases in an experimental program. The first phase deals with the planning for improvement of specific products or the creation of possible new products before any major sums are appropriated for actual experimentation. The second phase deals with the execution of the plan. The accounting group performs service functions in each instance by supplying important historical data used in developing the plans and by ac-

cumulating and comparing current actual cost of experimentation with budget estimates to guide management during execution of the plans.

Before approving expenditures for any experimental project, management should consider each of the following factors with respect to possible new or improved products:

1. Sales potential for the product at each of several price levels.
2. Manufacturing cost at each level of sales potential.
3. Engineering and experimentation cost.
4. Advertising and sales promotion cost.
5. New facilities investment cost, including write-off for obsoleted facilities, if any.
6. Patent or license problems.
7. Distribution costs.
8. Unusual credit and collection problems.
9. Labor availability and cost of training.
10. Raw material procurement difficulties.
11. Ability of the organization to execute plans.

In addition to the above factors, the element of timing is extremely important. Management must establish a time table for accomplishment, geared to season trends, manufacturing capacity, and to the competitive situation. The schedule will depend on factors peculiar to the organization, the product, and the industry.

The ability of the organization to execute plans is the fundamental factor in the second phase of a program for product improvement. Every division of the business organization is affected, namely:

1. Sales
2. Engineering
3. Manufacturing
4. Industrial relations
5. Procurement
6. Financial
7. Legal

Contrary to the usual impression, a new or an improved product is not a purely technical engineering problem but a challenge to the entire organization. There must be a sound organization structure with clear lines of communication to all levels and all areas, as well as properly delegated authority and responsibility for action within each area. If the organization lines of authority are prop-

erly drawn and communications adequately maintained, every step in planning and execution of the program is likely to be taken by the proper personnel at the right time.

The following costs must be included as factors in planning product improvement:

1. Manufacturing cost.
2. Advertising and sales promotion cost.
3. New facilities cost.
4. Distribution cost.
5. Labor training cost.
6. Engineering and experimentation cost.

Budgeting Experimental Project Costs

The New Holland Machine Division of The Sperry Corporation manufactures "farm engineered" equipment. Each basic business function of the division is headed by a manager. Liaison is effected through a management committee. All recommendations for expenditures for experimental engineering are approved by this committee before submission to the board of directors for review and final approval. The annual budget for experimental work covers three classes of items:

1. Variable costs on projects in progress and those specifically contemplated.
2. A lump sum for variable costs on unspecified projects.
3. Fixed general engineering costs not directly chargeable to projects.

The estimated expenditures for the current year for each project under Class 1 are stated separately. A lump sum is allocated for the unspecified projects composing Class 2 based on an estimate by the engineering division manager of the cost of projects which are still in the pre-planning stage. The budget for general engineering expenditures not directly chargeable to specific projects represents the fixed costs of operating the engineering division and is based on relatively determinable charges such as executive, supervisory, and staff salaries and travel expense, depreciation, taxes, and insurance. Since the engineering division is divided into operating departments (the setup is shown in Exhibit 1), the annual budget for each of the three classes of items is likewise departmentalized. Monthly reports are issued to show performance versus budget. For this reason each annual departmental budget is apportioned by months.

ENGINEERING DIVISION ORGANIZATION CHART
Chief Engineer
PATENTS
Attorney
SPECIFICATIONS
Supervisor
EXPERIMENTAL SHOP
Foreman
ENGINEERING SERVICES
Manager
MATERIAL TESTING
Metallurgist
COST ANALYSIS
Cost Engineer
ENGINEERING STANDARDS
Supervisor
FIELD TESTING
Manager
NEW DESIGN
Manager
DEVELOPMENT ENGINEERING
Engineers
PRODUCTION DESIGN
Manager
Senior Engineers
Senior Engineers
Senior Engineers
Draftsmen
Draftsmen
Detail Engineers
FACTORY LIAISON
Senior Engineers
DRAWINGS
Checker
DESIGN
Senior Engineers
Junior Engineers
Draftsmen

EXHIBIT 1

Subsequent to approval of the annual budget, commitments may be made against specific projects and for general engineering costs out of the lump sum approved for future projects. However, expenditures out of the lump sum provided are not made until approval of each specific new project by the management committee. The specific project proposals are submitted by the engineering division manager after preliminary investigation of the sales potential, the engineering time and cost involved, and the relative cost to manufacture the product. Expenditures up to $5,000 for preliminary investigation of any product improvement project may be authorized by the management committee but such sums must be charged against the lump sum provided in the budget for new projects.

Accounting Classifications of Experimental Costs

Each control established by the New Holland Machine Division is designed specifically for a definite class of cost and this applies to costs for experimental work which are divided into three classes for separate accounting treatment:

1. Costs allocable directly to specific projects.
2. Costs allocable to specific projects through application of overhead rates.
3. Costs chargeable to general engineering expense.

Costs allocable directly to specific experimental projects include: (1) raw material and purchased parts used directly in construction of pilot models, (2) engineering salaries and wages for creative design, drafting, pilot model building, material testing, and field testing and inspection of pilot models, and (3) sundry costs, such as traveling and outside technical services required for specific projects. Costs allocable to the projects through the use of departmental standard overhead rates cover payroll taxes and compensation insurance, payroll bonuses, overtime premium pay, maintenance of equipment, and departmental operating supplies. Costs not directly chargeable to projects but charged to general engineering expense consist of engineering division executive, supervisory, and staff salaries and travel expense as well as depreciation and realty taxes and insurance applicable to engineering division facilities.

As noted below in respect of entries for the various principal items of experimental cost, allocable costs are first charged (contra

to relief of inventories, wages payable, or accounts payable) to experimental cost accounts by projects. They are then recharged to experimental expense control account but the credit is not made to the project cost accounts but to a clearing account later closed in total thereagainst, so that the project cost amounts will remain intact for budget comparisons. Another feature of our accounting for experimental costs is that the aggregate of all such costs for the month—accumulated in the experimental work in process account and charged off on the general ledger for profit and loss determination—is re-entered therein in memorandum fashion for control purposes, offset by an equal reserve. The cost of each project as completed is written off against this reserve.

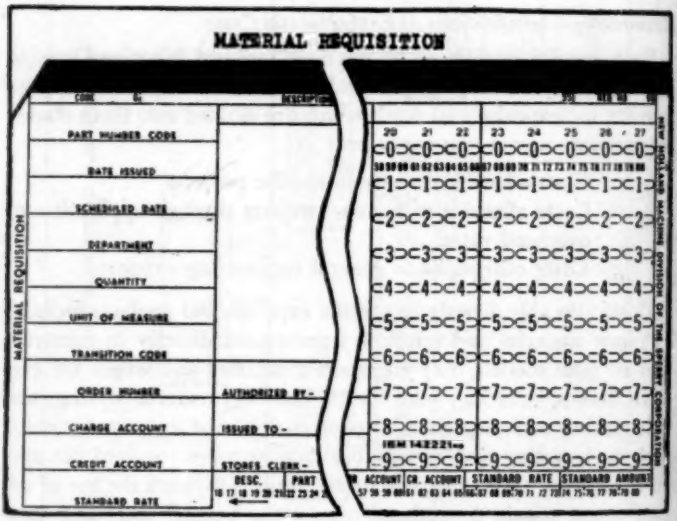

EXHIBIT 2

Raw Materials Used in Experimentation

Raw materials required for use on experimental projects are withdrawn from general storerooms on the standard form of materials requisition illustrated by Exhibit 2. The cost is charged to an inventory of experimental materials. The total quantity of each class of raw material used for a month is reported on the distribution sheet shown as Exhibit 3. The engineering services manager

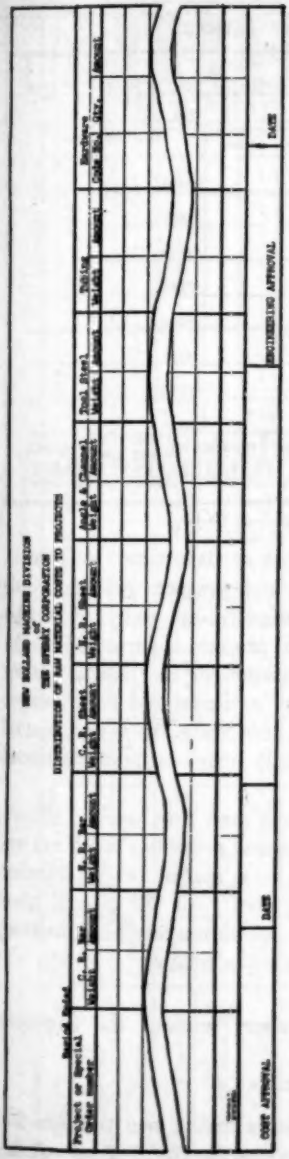

EXHIBIT 3

distributes the total cost to specific projects as called for on the form and forwards the distribution to the cost accounting supervisor to journalize the transfer from experimental materials inventory to the experimental materials expense accounts. Special material and parts purchased for use on experimental projects are handled through the invoice register distribution made by the cost accounting supervisor, the charge going in this case also to the experimental materials expense accounts.

To account for experimental materials *actually used* during the month, a debit is made to experimental work in process account with credit to departmental expense clearance account. As has been indicated the credit is made to an expense clearance account rather than to the expense account previously charged in order that the original account balance may be compared with the budget.

Experimental Staff Payrolls

All personnel are paid through one of three payrolls designated as "A" payroll which covers all hourly paid plant employees, "B" payroll which covers all hourly paid office employees except executives, and "C" payroll which covers salaried employees. Employees on the "A" payroll perform work only on specific proj-

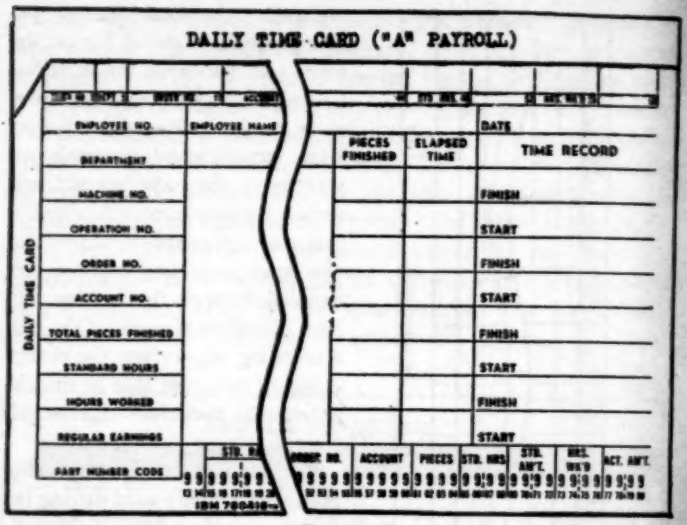

EXHIBIT 4

ect assignments. They report their work on daily time (job) cards, Exhibit 4, using a separate card for each project. All time cards are reconciled with individual attendance records daily. A tabulation of payroll charges to experimental projects is forwarded to the cost accounting supervisor, for preparation of the journal entries to charge experimental labor expense accounts and credit wages and salaries payable. The real control here lies in the assignment of work on a specific job basis, with a daily review of results attained as reported on the time cards.

Employees on the "B" payroll report their time weekly, allocating the time to specific projects whenever possible. Work not related to specific projects is charged to a special project number established to accumulate nonproject labor. All "B" payroll labor is summarized weekly in triplicate by the engineering division, Exhibit 5, with distribution of the copies as follows:

1. To "B" payroll supervisor.
2. To cost accounting supervisor, without the employee names and hourly rates.
3. Filed in engineering division.

Control of "B" payroll labor cost is maintained through this weekly summary. In addition it provides the cost and payroll de-

NEW HOLLAND MACHINE DIVISION
of
THE SPERRY CORPORATION

Weekly Summary of "B" Payroll

Department _____ Period Ending _____

Employee Name	Hour Rate		Product Number 1029	1030	1031	1032	1034	1035	1036	1037	1040	1041	1042	1043	Totals Hrs.	Totals Amount
L. Smith	1.50	Hrs.	24	6	3	7									40	
		Amt.	36.00	9.00	4.50	10.50										60.00
J. Doe	1.75	Hrs.	10		20	10									40	
		Amt.	17.50		35.00	17.50										70.00
W. Brown	2.00	Hrs.	2	7	5	12	2	1	5	6					40	
		Amt.	4.00	14.00	10.00	24.00	4.00	2.00	10.00	12.00						80.00
B. Frank	1.60	Hrs.	14		8	6	6	3	3						40	
		Amt.	22.40		12.80	9.60	9.60	4.80	4.80							64.00
C. Moore	1.75	Hrs.		5		10	4	6	5	10					40	
		Amt.		8.75		17.50	7.00	10.50	8.75	17.50						70.00
R. Roe	1.30	Hrs.		10	5	25									40	
		Amt.		13.00	6.50	32.50										52.00
A. Jones	1.75	Hrs.		10		7	3	4							24	
		Amt.		17.50		12.25	5.25	7.00								42.00
L. Warner	1.25	Hrs.		5	5	10	10	2	3	5					40	
		Amt.		6.25	6.25	12.50	12.50	2.50	3.75	6.25						50.00
R. Fatt	2.00	Hrs.	4	6	2	10	12	6							40	
		Amt.	8.00	12.00	4.00	20.00	24.00	12.00								80.00
G. McCann	1.50	Hrs.		3	6	10	10	4	7						40	
		Amt.		4.50	9.00	15.00	15.00	6.00	10.50							60.00
		Hrs.														
		Amt.														
		Hrs.														
		Amt.														
		Hrs.														
		Amt.														
TOTALS		Hrs.	87.90	85.00	88.05	171.35	77.35	44.80	37.80	36.75					384	
		Amt.														628.00

EXHIBIT 5

...) cards, ...e cards ...d to the ...entries ... wages ...ment of ...ttained

...allocat- ...not re- ...number ...ll labor ...vision, ...ployee

...gh this ...roll de-

partments with identical information. Monthly, the payroll supervisor prepares the journal entry charging the "B" payroll engineering labor to the experimental labor expense accounts and crediting wages and salaries payable.

Employees on the "C" payroll do not report their time. Consequently, the total is charged to experimental salaries account and reflected in the general engineering expense. The payroll supervisor prepares the monthly distribution of this payroll, debiting engineering general expense and crediting wages and salaries payable. The control of "C" payroll cost is the direct responsibility of the engineering division manager. His development of a sound organization requiring the least executive supervision is the real answer to cost control.

Charges to the experimental labor expense accounts from the "A" and "B" payrolls are made monthly to experimental work in process account by credit to the experimental labor expense clearance account. Here again the clearance account is used instead of making the credit directly to the original expense, so that proper budget comparisons may be made. The "C" payroll charges remain in the engineering general expense accounts.

Sundry Direct Project Costs

Sundry items of expense chargeable directly to projects cover outside engineering service fees and travel expense of new design engineers and field test men, other than executive travel. Neither of these types of expense may be incurred without the approval of the engineering division manager and both types are always directly related to specific projects. Approved expenses are vouchered and entries made to debit experimental expense, travel, or outside services and to credit accounts payable, followed by entries to debit experimental work in process account and credit experimental expense clearance account to accumulate the expense in experimental work in process account.

Overhead—Allocable and Unallocable

Departmental overhead is allocable to projects on a standard percentage of direct labor applied. The variance between the cost so allocated to projects and the actual overhead costs incurred is transferred to engineering overhead variance. The entries are a charge to the appropriate experimental expense accounts and credit

THE PORTLAND GENERAL ELECTRIC COMPANY
AND SUBSIDIARY
Statement of Power Division Project Expenditures as of January 31, 1949

Project Number	Total amount Approved July 1949	Expended 1949			Unexpended Balance		Purchase Commitments	Adjusted Estimated Balance July 1949	Amounts Expended Prior Years	Total spent on Project To Date	Completion Date		Comments
		Current Month	Prior Months	Year to Date	Over	Under					$	Date	
[illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]		$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	$ [illegible]	[illegible]	
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

to accounts payable to record items of expense, debit to experimental work in process account and credit to experimental expense clearance control to transfer expense to work in process, and a debit to experimental overhead variance account with credit to experimental expense clearance control.

Expenses previously defined as fixed overhead are charged to appropriate engineering general expense accounts. None of this expense is allocable to projects, the total amount being transferred at month's end to engineering overhead variance, thence to work in process at a standard rate, leaving only the net variance in the overhead variance account.

Month End Closing Entries

All the transactions which have been illustrated have carried charges into experimental work in process account. As explained earlier, the total monthly charges to experimental work in process account (expensed from a general ledger viewpoint) are debited for memorandum control to the experimental expense control account with an offsetting credit to a reserve for experimental work in process. The total cost of any project closed is removed from the experimental work in process account by a credit thereto, with the offsetting debit made to the reserve for experimental work in process account. Monthly, a statement of experimental project expenditures is submitted to the management committee and other executives in the form displayed in Exhibit 6.

Summary

Product improvement is vital to the continuance of profitable operations and is attainable only through an adequate program for experimentation. Such a program can be tremendously expensive if not properly planned, even though every effort is made to control detailed expenditures. It is very evident that the real control of experimental costs lies as much in proper planning as in efficient execution of the plans. Although accounting serves management in both phases of its control, accounting does not control. It merely reflects facts.

PROCESSING ACCOUNTS PAYABLE IN A LARGE COMPANY

by O. A. REDHAIR, Manager of Accounting,
and P. J. EICHINGER, Factory Accountant,
Westinghouse Electric Corp.,
Sharon, Pa.

Recent presentations on the subject of accounts payable procedure have tended to stress elimination of procedural steps, economy of clerical time, and use of mechanical equipment. This paper, narrating the routine in force in a plant of substantial size, directs its primary attention to protective features worked into the system under which purchasing and receiving documents, together with the vendor's invoice, are processed prior to payments to suppliers.

THE necessity and importance of effective control of payments to suppliers is brought forcibly to our attention when we consider that the amount spent by the average company for materials and services may be approximately the same as the amount expended for total payroll. Adequate safeguards must be erected and sufficient measures instituted to insure that payments are made at correct prices for exact quantities of materials ordered and received or for services rendered. Although the actual disbursement is usually issued by the accounting department, there are underlying elements of control the efficiency of which depends largely upon proper discharge of responsibilities of other departments such as purchasing, receiving, and traffic. Therefore, the value of close cooperation between the accounting department and these departments cannot be overemphasized. This article is based upon a case study of the plan in use by a manufacturing plant employing approximately eight thousand people, operating a system of standard costs, and making payment of approximately five thousand suppliers' invoices a month for a wide variety of materials obtained from numerous sources.

Starting Point: Manifold Purchase Order

Since the inception of accounts payable transactions begins with the purchase order, it would perhaps be helpful to first briefly consider the functions of the purchasing department. The primary responsibility of the purchasing department is to obtain materials

and supplies of the required quality at the proper time and at the best possible prices. At one time, this was largely a matter of sending out inquiries, obtaining quotations, choosing the supplier who offered the lowest price, and then proceeding with the clerical work incident to placing the order. During the last war and immediately following, purchasing efforts have been largely devoted to improving relations with suppliers, thereby gaining a better understanding of their processing and selling problems. As a result, a scheduling technique was developed to assure a continued supply of quality materials which otherwise would have been very difficult to obtain in the postwar seller's market when demands upon suppliers were far in excess of their capacity to produce. By better correlation between supplier and purchaser, interruptions in production schedules were minimized.

Under the system which our organization uses, the production, stores, or other department requests the purchasing department to procure the needed materials or services. A multiple purchase order is issued giving the name and address of the supplier, specific description of the material, quantity desired, price, shipping date, transportation routing and terms, payment terms, and any special instructions, if needed. The original and the acknowledgment copy are sent to the supplier who returns the latter as indication of acceptance of the order under the terms given.

The remaining copies are distributed in four directions. One copy is sent to the accounts payable section of the accounting department for later use in matching with the supplier's invoice. One copy (produced in hectograph ink) is forwarded to the receiving department for later use in preparing receiving reports on which they must write in the specific information regarding quantity received, date received, method of shipment, etc. Another copy is sent to the tabulating section for preparation of a tabulating card record of open commitments with suppliers. A final copy is retained in the purchasing department file. Purchase orders are usually confined to *single items of material* in order to permit ready identification and delivery to department requiring it and to facilitate distribution of charges to accounts through the use of a copy of the receiving report for this purpose.

Vendors' Invoices Received and Checked

The instructions on the purchase order direct the supplier to mail his invoice to the accounts payable section. This is a par-

ticularly helpful feature, since all invoices are promptly forwarded to the accounts payable section when received. Delays and misroutings are thereby avoided and the maximum time is available for processing the invoices for payment. Thus, invoices are received by the accounts payable section direct from the supplier. The first operation is the application of a checking stamp which provides information showing the following:

Date received
Due date for payment
Approval for material quality and quantity
Price approval
Price extension
Account to be charged
Transportation terms
Collect
Prepaid
Freight allowed
Freight not allowed
Express authorized by railway, motor, or air

This stamp is applied only to the original invoice. Any duplicate copies of invoices which may have been requested for special purposes are immediately stamped "duplicate" in order to avoid the possibility of duplicate payment. The invoices are checked against the accounts payable section file copy of the purchase order for verification of unit price, transportation terms, discount date and terms, type and quantity of material. If the invoice is found to be in order, the date and amount are posted to the file copy of the purchase order and a tabulating card is prepared and sent to the tabulating section to retire or reduce the commitment. If the order is satisfied by a single shipment, it may then be removed from the active file in the accounts payable section. However, if a number of shipments are required to complete the order, each shipment is recorded in turn until the order is finally completed. Where a standard allowances of a small percentage is permissible for over or under shipment, it is sometimes difficult to determine just when an order is completed. Experience and judgment are required in order to follow orders on which multiple shipments are involved to keep the active file free from completed orders.

If the invoice price or other terms are not in agreement with those stated on the purchase order, the invoice is not posted to the record copy of the purchase order but is held in suspense and referred to the buyer in the purchasing department for investigation and correction, or an explanation of the discrepancy in case no corrective action is required. Any explanation received is filed with

the file copy of the purchase order for use in checking additional invoices on this order. If the supplier's bill is late and payment must be delayed because of question in price or other matters, a printed form is sent to the supplier notifying him that correction is necessary and that cash discount, if applicable, will be deducted when payment is made, as promptly as possible.

Receiving Report Validates the Invoice

One copy of the receiving report designated as the accounts payable copy is routed directly to the accounting department from the receiving department. This receiving report is a copy of the purchase order to which the receiving department has added specific information regarding quantity received, date received, carrier's name and car number (if rail shipment), number of containers, weight, and whether the shipment was received prepaid or collect. The receiving department attaches the "arrival notice copy" of the transportation bill to the receiving report and forwards both to the transportation clerk in the accounting department.

The transportation clerk checks the documents, making sure that the terms of transportation (collect or prepaid) are correctly indicated on the receiving report, transcribes the purchase order number and the account to be charged from the receiving report to the copy of the freight bill, and detaches the freight bill. This arrival notice copy of the freight bill is later matched with the original freight bill by the transportation clerk, to make sure that transportation is paid for only verified service, and is subsequently used for distributing incoming transportation to appropriate accounts.

The receiving report from which the arrival notice copy of the freight bill has been detached, is sent to the matching clerk who compares it with the supplier's invoice to determine that the quantity invoiced agrees with the quantity received, that transportation is in agreement with approved terms indicated in the checking stamp on the supplier's invoice, and that the extensions on the supplier invoice are correct. Minor errors are called to the attention of the supplier by use of a printed form, where corrections are necessary, and payment of the adjusted amount is then carried out in the regular manner.

If damage has occurred in transit, action is initiated to give the claim clerk the necessary documents for presentation of the claim on shipments sold f.o.b. shipping point. If the shipment was f.o.b.

destination, the supplier is responsible for recovery and he is notified at the same time that the value of the loss is charged back to him. In order to obtain this information, the receiving department prepares a "bad order or short" report at the time such material is received.

If the daily lot of supplier's invoices contains bills which are due for payment within two days to obtain discount and receiving record is not available, special handling is required to avoid losing discount. Photostatic copies of the invoices are produced for later matching with receiving reports and the original supplier's bills are stamped "special payment" and forwarded to the disbursement group, where, as paid, they are charged temporarily to a special in-transit inventory account. The original bill is filed with a copy of the voucher to support the payment. The photostatic copies become the subsidiary ledger details supporting the special account and are carefully checked daily to insure prompt clearance to regular accounts after material is received.

Recording Liability and Charging Inventories

If all items of the supplier's invoice are in order or after required adjustments have been made, the invoice date and amount are transcribed to accounts payable copies of the receiving report. At this point, an adding machine listing showing purchase order number and amount is taken separately for the gross total of supplier invoices and for the total amount transcribed to the receiving reports. The tapes must be in agreement because charges to various accounts are later made from the receiving reports and the total must equal the gross amount of the invoices. These record copies of the receiving reports are next routed to the clerk handling the inventory account for material with suppliers, so that cost of material can be added if the company has furnished material to a supplier. (A code is used on the purchase order to indicate when such material is furnished, so that only orders so coded need be followed).

The receiving reports are then used to distribute daily charges to the various accounts affected with credit to accounts payable liability account for gross amount of the invoices. Wherever possible, the copy of the receiving report is used as a posting document for charges to expense accounts. Determination of material price variances from standard cost, taken up when material is purchased,

is likewise developed by a use of copies of receiving reports in a manner to be described later in this article.

Passing Payment: Voucher Check Preparation

The supplier's invoices, with the adding machine tape indicating the total, are passed on to the disbursements group where discounts are calculated and indicated on each invoice. The invoices are then sorted by due date and by supplier. Adding machine tapes are again prepared in duplicate to obtain the total for each due date and a summary total. By use of a duplex listing machine, the summary total may be accumulated in a separate register in one operation. The invoices for each due date are itemized in the listing to due date, including month, year, and installment number. The summary total must be in agreement with the gross total of the invoices on the tape received from the matching group, which has set up the accounts payable liability and has distributed the inventory charges from the copies of the receiving report. One copy of the adding machine tape is separated into sections showing the items applicable to each due date, thus providing individual tapes by due date which are stapled to the corresponding invoices and filed in individual date folders. The duplicate copy of the tape is kept for reference, as the total represents the daily credit to the liability account.

Each day the invoices due to be paid are withdrawn from the due date folder and an adding machine tape is run to determine the gross total. This is done by adding the totals on the tapes attached to each group of invoices due on this particular date. The total represents the amount included in the credits previously set up in the liability account. Before preparing vouchers, a special inquiry is made into possible charges against suppliers which should be deducted. Record of such charges is kept in a separate file for the purpose of this daily review in order to avoid payment to suppliers who may be indebted to the company. Invoices are then sorted to supplier and an adding machine listing of discounts to be deducted is prepared by supplier and each discount tape is attached to the invoices for each supplier. A second adding machine tape is prepared by supplier showing a subtotal for the gross amount of the invoices and accounts payable corrections and a further deduction of discount in one amount to obtain the net amount of payment due.

These amounts are summarized to obtain an amount for reconciling the gross total of all invoices due that day with the net payment, through corrections and cash discount. Invoices are then given to the typist, with tapes attached, for preparation of voucher checks. The supplier's invoice number or other identification, date, gross amount of each invoice, and each correction (if any) are listed on the check, as well as the discount and net amount of payment. After the checks are typed, a preaudit is made of the details included in the payment to each supplier. This is done by an individual other than the typist or the person who summarizes the bills prior to the typing of the checks. The person performing the preaudit signs the file copy of the voucher for each supplier.

The checks and details are routed to the controller's representative for a final review and signature of the checks which are then submitted to the treasury representative for final signature and mailing to the supplier. Three copies of the voucher portion of the check are retained for record purposes. The number one copy is used for numerical file and detail record. The number two copy is retained for the alphabetical file. The number three copy is used for preparation of a statistical report classifying expenditures to inventories, capital equipment, transportation, appropriation expense, public utilities, and other.

A daily cash report of the total expenditure is sent to the treasury department in order to keep it currently informed of the amount of cash disbursed. The report lists the check number, gross amount of the invoice, discount deducted, and the net amount of the check. From the totals of this report, entries are prepared to charge accounts payable with the gross amount of the invoices paid and to credit cash discount and cash in the appropriate amounts.

Priced Receiving Reports to Record Material Price Variance

A special account is charged with the actual cost of raw materials and finished parts from the accounts payable section copies of the receiving report, to which the cost has been transcribed from the supplier's invoice. This special account is credited with the standard cost of raw material and finished parts from the copies of the receiving report routed first to the storeroom or to the inventory location with the material and then forwarded to the stores

ledger clerk for posting of quantity receipts and for pricing at unit standard cost. These are extended in the stores ledger department and further forwarded to the accounting department with a proof sheet providing a total standard cost for the reports included in each lot, to serve as support for the entry charging the proper inventory account at standard cost and crediting the special account.

The balance in the special account is then aggregate inventory price variance. The copy of the receiving report used to record the actual cost is matched with the copy received from the stores department, used to record standard cost, and the variance is charged or credited to the appropriate material price variance account, thereby clearing the special account.

An Effective System

Our experience with the procedure described in this article has been that very little if any discount is lost and that very few erroneous or duplicate payments occur, despite the numerous payments issued and the large amount of clerical work necessarily associated with a heavy volume of transactions. Many problems are encountered in connection with particular practices of the various suppliers, which create problems that can only be solved by day to day contact with such experiences. One of the most troublesome situations with respect to the possibility of duplicate payments is occasioned by the receipt of a second invoice from a supplier while the first invoice is being "paid special," i.e., without a receiving report, in order to obtain discount. This happens only on rare occasions. Problems are sometimes created where more than one shipment of the same quantity at the same price is included on a purchase order if one or more shipments arrives on the same date. From time to time, other problems are, of course, encountered with individual suppliers or special circumstances. These usually can be solved by special attention and study.